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date: August 4, 1971

to: Distribution

from: T. H. Crowe

subject: Projected Delivery Weight of SL-1 Payload - Case 610

MEMORANDUM FOR FILE

One way to project delivery weights of flight hardware is to utilize past performance data and current maturity data. In general use is a three-category system of expressing maturity of weight data -- Estimated, Calculated, and Actual. The data is categorized as estimated when a conceptual design has been completed and the weight of this design has been estimated. The weight is categorized as calculated when production drawings have been released and the weight of the design calculated from thes drawings. The actual category is reached when production is completed and the part, blackbox, or module is weighed. Performance of different design groups varies greatly. An examination of data on several programs indicates that generally as maturity of weight data moves from estimated to actual, a growth of about 15% occurs and as the maturity moves from calculated to actual the growth is about 6%. This growth occurs from underestimating and under-calculatin weight and from "make it work" changes.

The growth rate is not a linear function of the maturity of the data. It is usually steeper at the beginning of the program and becomes almost asymptotic as the weight data approaches 100% actual. To test the applicability of the 15% and 6% factors applied in a linear manner to the SL-1 payload, real growth and growth expected from the changes in maturity have been plotted in Figures 1 and 2 for the first six months of this year. The program moved through the mid-point on maturity of data during this period. The change in maturity of data is given below:

	Estimated	Calculated	Actual
1/71	22%	49%	29%
7/71	9%	40%	51%

As can be seen from Figure 2, the expected growth of the SL-1 payload from changes in maturity of data is about 15% less than the actual growth. Two reasons are postulated for this error. First, the factors do not allow for adding or deleting capability. An examination of the actual changes during this time period indicates that about half this 15% error can be accounted for because of added capability; such things as a tool kit, quartz crystal microbalances, additional towels, wash cloths, and clothing, a leak detection system, and equipment to extend the use of Experiment M133. Secondly, the factors were not intended to account for such gross errors in calculating and estimating as occurred in the wiring systems of the ATM.

At any rate the factors seem sufficiently accurate to make worthwhile an attempt to estimate the delivery weight of the payload. Derivation of this estimate is given below:

	Control Weight (lB)	7/71 Weight (lB)	7/71 Maturity Data (%)			Projected Growth (lB)
			E	C	A	
ATM	24,650	24,437	0	23	77	336
MDA	13,800	13,471	10	46	44	571
AM	49,000	48,656	4	50	46	1750
IU	4,550	4,420		100		265
OWS	78,000	75,229	18	49	33	4250
PS	2,600	25,531	0	1	99	15
TOTAL	196,000	191,744	9	40	51	7187

This results in a total estimated launch weight of ≈199,000 pounds, 3000 pounds above the control weight. This estimated weight includes no allowance for adding capability to the payload.

T. H. Crowe

1025-THC-1i

Attachments

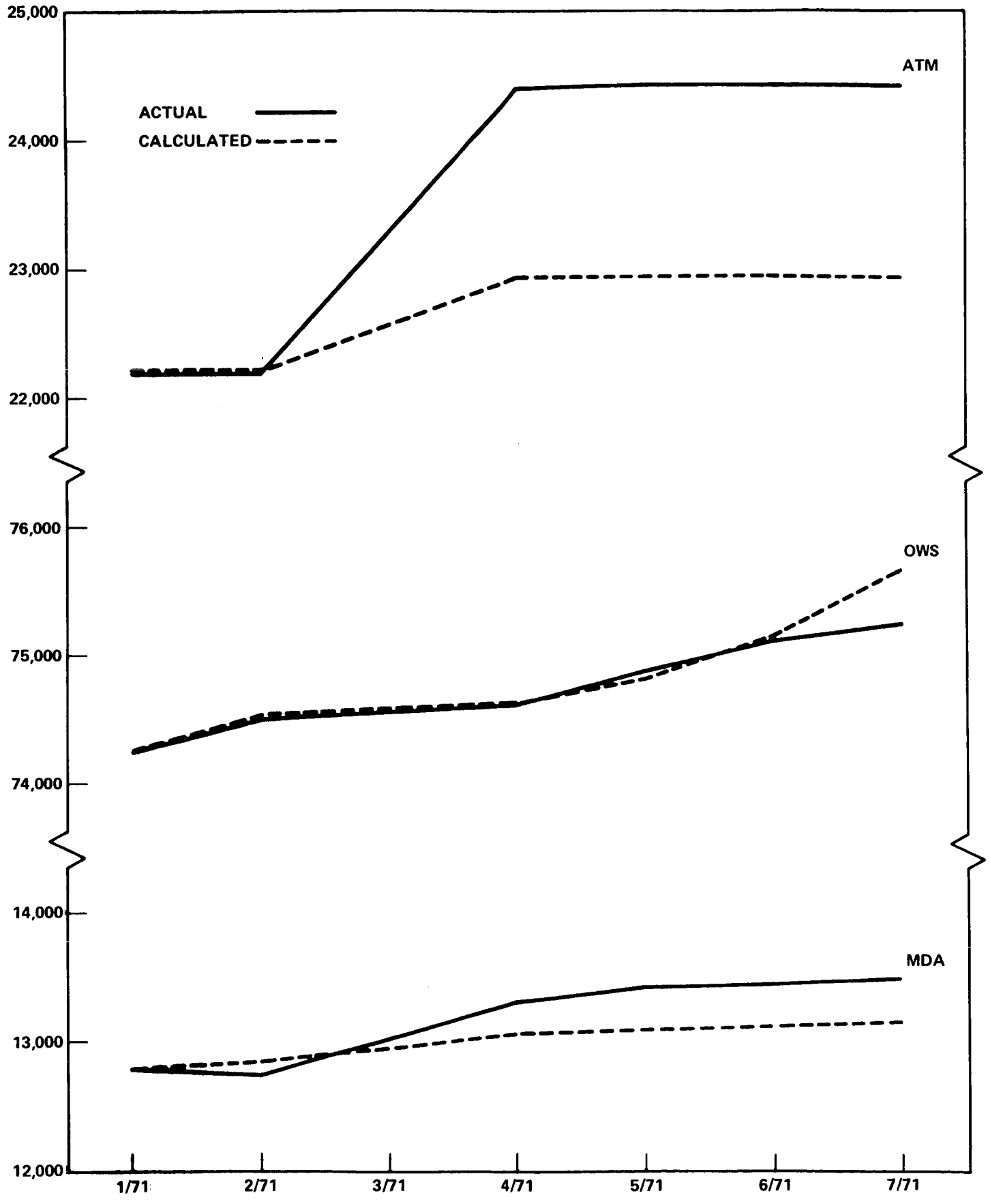

FIGURE 1 - WEIGHT GROWTH OF SKYLAB 1 PAYLOAD

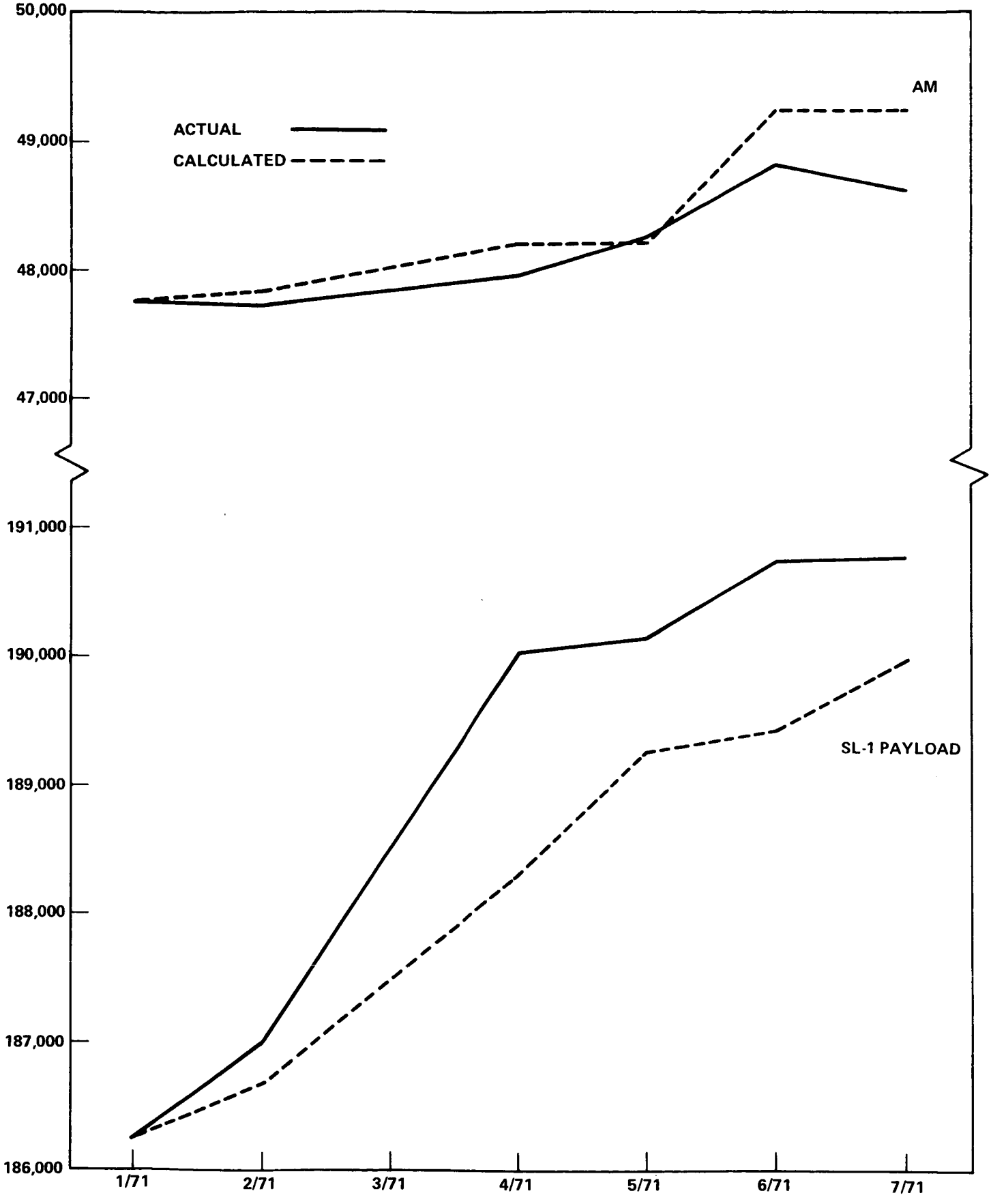
50,000
49,000
48,000
47,000
AM
ACTUAL
CALCULATED
191,000
190,000
189,000
188,000
187,000
186,000
SL-1 PAYLOAD
1/71
2/71
3/71
4/71
5/71
6/71
7/71

FIGURE 2

Subject: Projected Delivery Weight of SL-1 Payload - Case 610

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